Section 3. Outstanding Projects of 2005

Five projects in this year's annual progress report exemplify outstanding coordination, design, and implementation:

- Stibnite Mine restoration, which includes the Glory Hole and Meadow Creek Projects, 2003-2005
- South Fork Cottonwood Creek Watershed Enhancement Project – Phase I, 2001-2004
- Upper Thomas Fork Creek Stream Bank Stabilization Project, 2003-2005
- Kinsey Corral Relocation and Riparian Fencing Project, 2001-2005
- Perrine Coulee Irrigation Return Flow Settling Ponds and Wetlands Project, 2003-2005

Summaries for each of these outstanding projects are presented in the following.

This page intentionally left blank for correct double-sided printing.

Stibnite Mine Restoration: Glory Hole and Meadow Creek Projects

The goals of this multi-pronged effort have been to eliminate nonpoint source production and delivery of sediment and metals from historic mine roads, abandoned mill tailings impoundments, and mine waste dumps for the Glory Hole and Meadow Creek projects. Located along the *East Fork of the South Fork of the Salmon River* watershed, in eastern Valley County, Idaho, the project lies in the heart of salmon country and is one of only four drainages in the Columbia Basin that supports populations of B-run wild, native steelhead (*Oncorhynchus mykiss*). Adfluvial Bull Trout (*Salvelinus confluentus*) and cutthroat trout (*Oncorhynchus clarki lewis*) also occupy these waters, completing a very complex salmonid community.

The watershed also has socio-economic significance, providing multiple beneficial uses for Idahoans and tribal rights, such as subsistence hunting and fishing and religious practices, for the Nez Perce and Shoshone-Bannock tribes. Land uses in the watershed include road construction, logging, mining, hunting and fishing. Approximately 100 miles of rural county roads, and millions of tons of heavy-metal-ladened mine and mill tailings in the watershed, have been exposed to wind and water erosion. Production and delivery of sediment and heavy metals caused degradation of water quality and fisheries habitat throughout the watershed.

Poor water quality, adverse modifications to aquatic habitat, and creation of barriers to natural fish passage have been the three biggest problems in the watershed.

Over $800,000 in section 319 Grants were awarded to DEQ to implement the Meadow Creek Restoration and Glory Hole Projects; over $300,000 in state general funds and $125,000 of volunteer, in-kind labor contributions have supplemented the section 319 funds.

Completed Tasks: Glory Hole

Tasks completed for the Glory Hole project include the following:

<u>Bradley Waste Dump Removal</u>

Overlooking the Glory Hole is the massive Northwest Bradley Waste Dump, site for disposal of what appeared to be mill tailings and laboratory wastes. Risk analysis indicated that metals concentrations at the surface posed a significant health risk to tourists and that leaching of these metals and those in the interior of the dump contributed to metals concentrations in the river.

DEQ, the USDA, and EPA collaboratively designed removal projects to encapsulate tailings over an area of significant recharge to the dumps, thereby eliminating both the exposure for visitors and reduce the leaching of metals from the dump. A composite cap, consisting of Bentomat®[2] top soil and vegetation should reduce these risks significantly.

Monday Camp Dump Access Road Closure

The only access to the Monday Camp was the cause of significant stream bank instability, responsible for production and delivery of in excess of five (5) tons of sediment per year (Figure 3).

Figure 3. Approximately 1.5 miles of access road to the Monday Camp Dump was redeveloped for access to the project. The historic roadway was marred by massive slope failures and deeply incised gullies on fill slopes. The road represented a major eroded surface and source for fine sediment delivery.

At the conclusion of the Monday Camp Dump stabilization task, the road was obliterated. Because riparian vegetation had established along the river, fill slopes were not pulled back and re-graded against the cut banks, but approximately two (2) acres of road surface were scalloped, using a track hoe, and then treated with fertilizer and reseeded. In areas where runoff waters eroded deep gullies, the watercourse was deeply ripped and armored with coarse durable rock. Finally, the entrance to the access road was filled with 36” (and larger) boulders to prevent ATVs from traveling on the reclaimed area.

Monday Camp Dump Stabilization

The East Fork of the South Fork of the Salmon River flowed alongside and undercut over 500 linear feet of the toe of the Monday Camp Dump (Figure 4), contributing approximately 500 tons of what was presumed to be heavy-metals-ladened sediment to the delta beneath the cascade. With no opportunities to relocate the channel, the solution was to *lay back* the entire dump (Figure 5), stabilizing it by soils building and revegetation.

Stream banks were initially excavated to expose materials for testing of hazardous materials and heavy metals and to create a working platform. A long reach track hoe was used to selectively pull back mine wastes and leave established riparian plants.

2 Bentomat is registered trademark of CETCO Lining Technologies.

Figure 4. The river cuts through toe of the Monday Camp dump.

Figure 5. Monday Camp Waste Dump during stabilization task. Note the track hoe near the center of the picture.

Fifty thousand (50,000) tons of mine waste was removed from the dump face and placed on another angle of repose dump face with approximately two acres of vegetated buffer area (Figure 6). The location and the underlying buffer zone ensure that fines eroded and transported down-gradient will be captured and attenuated. Once the mine waste had been removed, the dump was re-graded and scalloped using the track hoe.

Figure 6 Stabilized Monday Camp Dump.

Construction of Sediment Basins and Wetlands on Historic Mine Benches

The Glory Hole consists of numerous historic mining facilities and a public county road that traverses the site. The mine waste dumps, ore stockpiles, mine benches, and roadways were constructed and abandoned with very little regard to drainage and overall stability; modeling suggested that implementation of BMPs in and around the access roads would result in reductions of between one (1) and five (5) tons per year of sediment produced and transported due to mass wasting and erosion.

During DEQ's inventory for organic and top soil resources, three top soil borrow sites were identified that could be developed as sediment traps for post closure BMPs. In addition, DEQ observed that some of the mine's benches were effectively trapping sediment and evolving into ponds and functional wetlands.

After the top soil was removed from the borrow pits, DEQ had its contractor divert the drainage along the county road and the toe of the Northwest Bradley Waste Dump area into three borrow pits and a mine bench that were over-excavated to produce sediment basins. These basins were then roughed up, treated with top soil amendments, and planted with native seed mixtures (Figure 7).

Figure 7. Reclaimed sediment basin alongside of Glory Hole and the public access road was constructed from a top soil borrow source that was developed for the reclamation work in the Meadow Creek Valley.

Reclamation of Bradley Property Timber Project

Figure 8. Bradley Property Timber Project temporary stream crossing prior to reclamation work done under the Glory Hole CWA section 319 Project.

Figure 9. Obliterated Monday Camp Access Road after reclamation of the Monday Camp Dump.

Although a timber project was contracted by the Bradley Mining Company and regulated by the Idaho Department of Lands, the operator failed to fully reclaim the project area. Seizing an opportunity to acquire additional raw materials, DEQ and Thornton Construction salvaged slash and top soil, removed a poorly constructed stream crossing (Figure 8), and completed some of the timber company's reclamation work. When completed, DEQ reclaimed approximately 200' of timber roads and a one-acre area of disturbed lands that had been used to stockpile slash and logs.

Approximately 200 tons of large woody debris and 1,000 cubic yards of top soil were removed from the timber project area (Figure 9). The top soil had apparently been stockpiled during historic mining activities and was not discovered until Thornton construction began reclamation of the timber project. This large woody debris was stockpiled at the Meadow Creek Project site pending its use on constructing vegetated islands and general scatter.

DEQ seeded the reclaimed timber project with approximately 30 pounds of native seed mixes and then used a tri-phosphate chemical fertilizer to help pre-winter germination. Small slash and rocks were placed to impede recreational use and protect the reclaimed areas. It is hoped that this work will result in the elimination of at least one (1) to five (5) tons of fine sediment production and delivery from this area.

Completed Tasks: Meadow Creek

Tasks completed for Meadow Creek include the following.

Revegetation of Meadow Creek Stream Channel

Prior to DEQ's projects, which began in 2003, very little vegetation had begun to establish itself along the stream bank (Figure 10, left). In 2003, volunteers made up of Boy Scouts, high school students and teachers, DEQ and Fish and Game employees, and a local outfitter started planting willow cuttings, and one-year starts of riparian species. Volunteers also helped broadcast native seed mixtures along the channel.

Figure 10. (Left) Meadow Creek Stream prior to 2003 plantings. (Right) September 2005, after plantings.

Figure 11. (Left) Poorly implemented BMPs prior to this project resulted in continued piping of heavy-metals-ladened tailings. (Right) Top soil backfilling and revegetation stabilized the springs, reduced flows, and curtailed delivery of tailings.

Vegetated Islands Development

Initially, it was believed that DEQ's project would not generate enough top soil and amendments to cap the *spent ore disposal area* (SODA). Consequently, DEQ decided to try the longer-term solution of creating productive islands of vegetation from which seed and organic debris would be generated in sufficient quantities to slowly cover and re-colonize the SODA (Figure 12-Figure 14).

Figure 12. Islands were over-excavated one foot below the original surface and then backfilled with a mixture of spent ore, top soil, and compost to an average of one foot above the original surface.

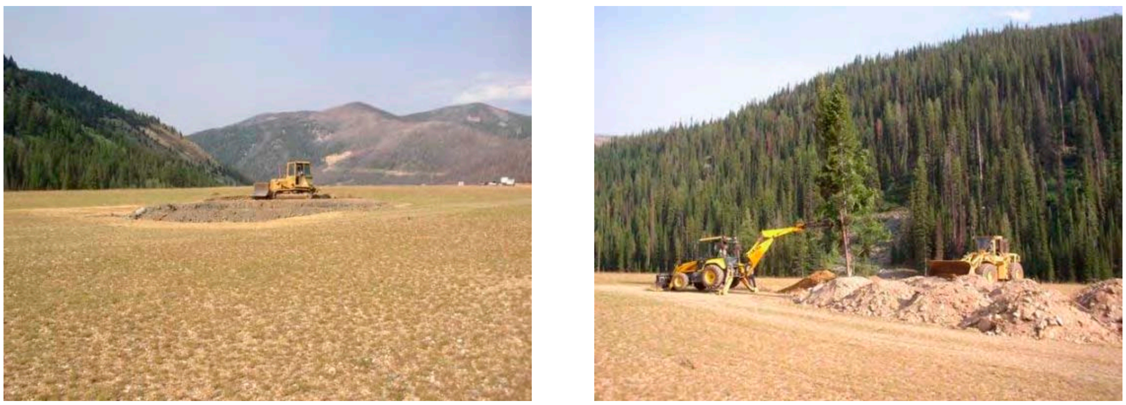

Figure 13. The placement of the backfill mixture created an absorbent island of growing material that would capture and retain surface runoff from the interior of the SODA until the moisture could be evapotranspirated, significantly reducing surface runoff that had previously caused most of the erosion on the SODA benches.

Figure 14. One year after creating the first vegetated islands, lush grassy species and large woody debris hide and shade over 9,000 plantlings of wild roses and lodge pole pines.

In total, for the 2004 and 2005 construction seasons, nine (9) islands, each of which are approximately a quarter-acre in size, were constructed. After one year, the first vegetated islands produced lush vegetation and acted like sponges to hold soil moisture content above ten per cent until mid September.

Development of DEQ Tailings Repositories

During the identification of non-point sources of surface water pollutants, it became obvious that up to 1,000 cubic yards of historic tailings would have to be removed from the stream channel and other locations to stabilize the site. The tailings would also have to be placed in a repository for final disposal.

Because DEQ was planning to construct a lined area to produce compost, it was determined that the repository could be placed beneath, which would provide the base of a composite cap for the repository. In addition, if the facility were located properly, it would not be impacted by surface or groundwater.

Construction began with excavating spent ore from an area approximately 175 feet by 275 feet (Figure 15). The excavation provided for a 150-foot by 150-foot surface that had a 0.5 percent grade towards a 400,000 gallon settling basin. The pond was designed to contain 48 inches of precipitation that may occur in winter, to prevent runoff from the compost into the nearby Meadow Creek.

Figure 15. (Left) Excavated spent ore from storm water ponds and placed as berm. (Right) HDPE liner is placed on compacted tailings above repository.

Approximately 600 cubic yards of excavated spent ore was placed around the whole area as a retention berm. The interior of the composting area and retention pond was then backfilled with tailings to create a subliner approximately one (1) foot thick prior to placement of a 60-mil high-density polyethylene liner and geotextile.

Development of Wetland Communities and Spring Expressions

The SODA's topography is dominated by two benches that adjoin Meadow Creek. Similar to geologic contact zones, the zone between these benches is a conduit for near surface ground water flow. In several locations, the flow is expressed at the surface as springs, the most notable of which is a five (5) acre area (Figure 16). Until 2004, the areas around these springs were completely devoid of vegetation, and, were sources for the production and delivery of an estimated five (5) tons of metal-bearing fine sediment to Meadow Creek.

Figure 16. Springs are present at the base of the upper SODA bench (left), which became the site for a five acre wetland development to contain and abate fine sediment production and delivery to the adjoining Meadow Creek channel (right).

In 2004, DEQ and its contractor, Thornton Construction, begin to develop these springs into functional wetlands, which would capture storm water runoff and the fine sediment it transported rather than acting as a source. With substantial soil amendments, these areas are already functioning to capture and attenuate sediment from the SODA (Figure 17).

The development of the lower bench wetlands began in 2004, on five acres beneath the most unstable portion of the upper SODA bench. Initially, the access road, which is frequented by recreational traffic, was built up with crushed rock to maintain a firm road base and increase surface water retention time around the springs at the base of the upper SODA bench. Then, approximately 1,000 cubic yards of a mixture of top soil, wood chips, and compost were spread across the entire five-acre area.

Several different surface expressions of the springs were planted to contain stratified vegetative communities (Figure 18). Plantings provided for a slight overlap between each community. In the center of the wetlands, where there is a continuous presence of water, cattails and rushes were planted. From just inside the peripheral edges of the cattails and rushes, to the ephemeral edges of the spring, a mixture of alders, willows, dogwoods, wild roses, and quaking aspen were planted. Lastly, lodgepole pines were planted in uplands areas that tended to dry out before August of each year.

Approximately three (3) more acres on the SODA were determined to be suitable for wetland development (Figure 19).

Figure 17. One year after seeding, approximately fifty per cent of the upland and riparian plantings died from drought and browsing by deer and elk. However, lush grassy species development now hides and shades the remaining plantlings.

Figure 18. One year after planting, thick growths of grasses and forbs hide ten-inch willow, alder, and aspen starts.

Figure 19. Additional wetland sites were developed on slopes where other springs expressed themselves or where annual surface runoff could be retained by placing top soil in a way that created a dam and sediment basin. The dams were planted with upland species while the bottoms of the sediment basins were planted with wetland and riparian species.

In the center of what had been the mine operator's main haul road were springs that easily converted into a nice quarter-acre wetland. Thornton Construction constructed several stair stepped islands and catchment basins immediately above the haul road wetlands, and then cross-ripped the surrounding area. An armored drain was installed to transfer water during spring runoff from the BMPs into natural wetlands at the base of the SODA. Lastly, these BMPs were seeded with native grasses and forbs and planted with approximately 1,000 ten-inch riparian and upland starts.

DEQ estimates that these complimentary BMPs will prevent an annual production and delivery of between one and five tons of metals ladened fine sediment.

As the 2005 construction season ended, DEQ observed that storm water ran off the USDA's repository on the SODA through three distinct watercourses. To contain the fine sediment and curb erosion, Thorn Construction constructed three (3) 1/8 acre islands/sediment basins across the watercourses. These islands/sediment basins were excavated to approximately 18 inches below the original surface of the SODA, and the excavated waste was blended with top soils and compost to develop a high quality growth medium. The islands were then seeded with the native seed mix, scattered with large woody debris and boulders, treated with tri-phosphate chemical fertilizer, and planted with upland and wetland trees and shrubs. Hopefully, these island/sediment basins will develop into functional wetlands.

After observing the success of developing wetlands communities on the SODA, DEQ decided to make use of composite cap on DEQ's repository and the sediment basin at its lower end to develop one last wetland area (Figure 20). Although the two-acre wetland would provide great habitat on top of the SODA, the evapotranspiration that would occur in and around this wetland would eliminate approximately 1.5 acre-feet (500,000 gallons) of recharge through the mill waste to the springs adjoining Meadow Creek.

Figure 20. (Left) Surface runoff and mass wasting of upper SODA bench is one of the more significant sources for fine sediment production ad delivery. (Right) The storm water catchment pond at the composting facility was developed as a wetland to continue to restrict surface water runoff and utilize it to develop a vegetative cover on top of the SODA.

<u>Re-contouring of SODA Bench</u>

The slopes of the upper SODA bench prevented vegetation from becoming established and resulted in high velocities of surface water runoff in the spring—the primary cause of 5-10 tons of metals-laden sediment that was carried to Meadow Creek annually, depending on precipitation.

Development of five acres of wetlands on the lower SODA is anticipated to assimilate any fines being released from the upper bench, or the wetlands may have a limited life. However, the steepness of the slopes of the upper bench was obviously one of the limiting factors to retention of soil moisture and revegetation.

It was determined, therefore, that Thornton Construction should lay the slopes back and treat the slopes with approximately 1,800 pounds of compost per acre, constructing more than 250 micro islands, and planting 120 trees and shrubs in those micro islands (Figure 21). The total area treated in this fashion was approximately 2,000 feet long and 300 feet wide (15 acres).

<u>Development of Armored Drains</u>

DEQ designed and constructed armored drains on the SODA (Figure 22) to convey high flows during spring and storm runoff through a series of sediment basins and wetlands, eliminating annual delivery of approximately five (5) tons of metal-laden sediment from the top of the SODA into Meadow Creek. The drains also decrease the amount of water percolating into the SODA and the subsequent leaching of dissolved metals, and they conserve and direct fresh water into the constructed wetlands and vegetated islands.

<u>Development of Vegetated Micro-Islands</u>

Prior to reseeding the slopes of the upper SODA bench, Thornton Construction dotted the landscapes with micro-islands (Figure 23). Thornton excavated approximately three (3) cubic yards of spent ore and replaced it with topsoil and compost in each of the micro-islands. DEQ then seeded the entire slope and planted four to six ten-inch starts of ponderosa pine and wild roses in each. It is hoped that the lush vegetation that develops on each of these micro-islands will provide long-term seed sources for trees and shrubs and slowly expand outward across the slope.

Figure 21. D-8 Caterpillar with apron feed compost spreader applies approximately 0.25 inches (1,800 lbs/acre) of compost to the surface of the re-contoured upper SODA bench. Subsequently a D-3 Caterpillar dozer cross-ripped the bench parallel to the contours to impede overland flows.

Figure 22. Constructed armored drain connects wetlands constructed at the composting storm water pond to the wetlands constructed on the lower bench of the SODA

Final Closure of Composting Facilities

Figure 23. Micro-islands were constructed on the re-contoured and composted upper SODA bench slope, spaced at approximately 50-foot centers. The micro-islands were constructed by excavating three cubic yards of spent ore, mixing it with two cubic yards of top soil and compost, and then backfilling the excavation. The micro-islands were then seeded and planted with lodgepole pines and wild roses.

Final closure of the 1.5 acre composting facilities played on several design concepts. The composting facilities lay on top of a lined mill tailings repository, which would be left intact, but the repository needed substantial protection against either disturbance or natural erosion and exposure. The remedy was a functional composite cap of top soil, heavy boulders, large woody debris, micro-islands, a constructed wetland, and lush vegetation. The high density polyethylene liner would, in turn, hold winter precipitation near the surface, like a perched aquifer, such that soil moisture would remain high for a prolonged growing season.

Summary

As a direct result of this project, the water quality trend will continue to improve and then stabilize at near pristine values. If the Nez Perce Tribe and USDA Forest Service are successful in obtaining grant monies to eliminate the last fish passage barrier in the Glory Hole, populations of both anadromous and resident fish species should rise sharply in the upper East Fork of the South Fork of the Salmon River and Meadow Creek. Within five to ten years after the project is completed, steelhead, Chinook, bull trout, and westslope cutthroat densities may be expected to reach 10.03/100m^2, 23.89/m^2, 8.00/ m^2, and 7.01/ m^2, equal to some of the population densities found in other tributaries to the below the mine.

South Fork Cottonwood Creek Watershed Enhancement Project – Phase I

Project Goal and Objectives

Goals and objectives for this project focused on the following:

- Cropland critical areas with excessive sheet and rill erosion as well as nutrient and pesticide losses that are impacting or have potential to impact water quality.
- Riparian critical acres with limited shade that produce higher water temperatures and areas with low stream bank stability.
- Animal Feeding Operation (AFO) critical acres that are impacting or have potential to impact water quality with bacteria or sediment during critical runoff periods.
- Road critical areas with excessive borrow ditch erosion and roads where tillage practices extend into the road right-of-way.

Critical area size

There are approximately 9,418 critical acres in the South Fork of Cottonwood watershed.

Treatment objectives

The objective of the South Fork Cottonwood TMDL Watershed Plan – Phase 1 is to recognize the resource concerns within the watershed and restore these resources to the point where the beneficial uses are supported and meet the state standards. With this in mind, the South Fork of Cottonwood Watershed Enhancement Project, in conjunction with the state NPS Program, is implementing a comprehensive program of BMPs to reduce in-stream temperatures, pathogens and sediment entering into the stream system and minimize the effects of nutrient loading on an estimated 4,700 critical acres.

The implementation of the Cottonwood project is a phased approach, with initial projects targeting primarily the South Fork of Cottonwood. The South Fork of Cottonwood has a watershed area of 12,557 acres with about 22 operators. The entire Cottonwood watershed has 124,439 total acres. The objective is to reach 50% of the critical acres within the watershed, or 46,665 critical acres with the ongoing implementation projects.

Acres Treated

We have treated 5,000 acres in the Cottonwood watershed using section 319 and Water Quality Program for Agriculture (WQPA) funds (Table 3). The majority of these acres are in six-year contracts. Other funding sources have treated an additional 517 acres in the South Fork of Cottonwood and 4,880 acres within the entire Cottonwood watershed. The table shows the amount of each BMP installed and the number of acres it treated.

A map showing the locations treated can be found in Figure 25, page 37.

Funding Sources

Acres have been treated using a variety of funding sources, which are grouped into two general categories: section 319/WQPA and other sources. The section 319 and WQPA funds are being used together to extend subgrant agreement times and cost share amounts as needed. The Division II Animal Feeding Operation section 319 grant was used to fund a feeding operation within the Cottonwood watershed.

Estimated pollutant reductions

Estimated pollutant reductions include the following:

- *Sediment* - There has been an estimated decrease in rill and sheet erosion of 10 tons/acre/year due to the implementation of no-till or direct seed; resulting in an erosion decrease of 45,780 tons/year for the Cottonwood watershed (Table 3).
- Approximately 325 head of cattle have been removed from stream banks by installations of fence and water facilities. Vegetative re-growth in these areas can be viewed in the photo documentation section, starting on page 38.
- *Nutrients* - Reduction of sediment losses often results in a reduction of nutrient losses since many nutrients are transported with sediment particles to the water source. Nutrient Management systems use soil tests to identify current soil nutrient levels before fertilizer is applied, reducing excess fertilizer applications.

Table 3. Estimated pollutant reductions for South Fork Cottonwood Creek.

Reduction Estimates					
Practice	Estimated Sediment Reduction	# Implemented	Potential Sediment Load Reduction	Potential Nutrient Load Reduction	Potential Bacteria Load Reduction
Direct seed	10 tons/acre/year	4,578 acres	45,780 tons/year	~500 lbs P/year	none
Sediment Basins & Ponds	15 tons/basin/year	1 basins	15 tons/year	negligible	none
Filter Strips	50% of sediment (average of 15 tons/acre/year sediment.losses)	3 acres	23 tons/year	50% of nutrients will be filtered	50% of bacteria will be filtered
Fencing and offsite water developments	stabilized stream banks in 2 to 5 years	6,533 feet of fence, 5 water developments	~1 ton / year	~500 lbs P2O5 ~300 lbs N	99% of in-stream deposits in treated areas

- Sediment load reductions at the field level are estimated at 45,780 tons/year—25,637 tons/year at the stream level.
- There is an estimated 50% reduction in bacteria and nutrients to live water from filter strips.
- Fencing and offsite water developments work together to eliminate or largely reduce livestock access to live water, creating a 99% to 100% reduction of in-stream manure deposits and, hence, bacteria

Monitoring results or indications

DEQ – A BURP crew monitored during the summer of 2005; results are available through the Lewiston Regional Office.

Nez Perce tribe – Nez Perce Tribe monitoring results for 2005, as summarized by Ken Clark (IASCD), are as follows:

Cottonwood Creek (at Darryl Newman's Bridge -- Mouth)

- Bacteria do not appear to be a problem.
- Phosphorus levels exceeded Idaho criteria of 0.10 mg/L for all but two of the sampling events. Phosphorus levels appear to have an inverse relationship to discharge rates. This is counterintuitive and deserves further explanation; phosphorus binds to soil particles and is typically seen in greater quantities in surface waters when flows and erosivity is highest.
- Total nitrogen levels were said to have violated Idaho criteria during spring flows, but were within acceptable limits during the summer months.
- Total Kjeldahl Nitrogen (TKN) on Cottonwood Creek at Newman's appeared to be very high during the sampling period.

Cottonwood Creek (at Columbus Crossing – prairie/canyon interface)

- Nitrogen and ammonia levels were seen as violating state standards at this site.
- Total phosphorus levels were very high during the sampling period, and showed an inverse relationship to discharge rates. Further investigation should be done; perhaps a type of time-release fertilizer was being used.
- Bacteria were not a problem.
- True discharge rates may have been higher than actually reported for all sites, since negative values were used at different sites to calculate discharge. Since streams do not flow uphill, the negative numbers must be due to measurements taken in an eddy; those numbers should have been discarded.

Cottonwood Creek (at Butte Site -- Headwaters)

This site was only sampled twice; it was frozen one of those times. No violations were observed.

IASCD - The actual results can be found in the monitoring report entitled *Tributaries of Cottonwood Creek Monitoring Results 2002* on the ISDA Web site:

- The monitoring program for Cottonwood Creek Tributaries was successfully carried out as planned. Protocols were followed, QA/QC standards were met, and specific information per TMDL parameter for each sub-watershed was collected.
- Dissolved oxygen exceedances were only observed on streams that almost or did go dry in mid summer.
- Instantaneous water temperatures standards were met at all sites with only one exception: at Shebang Creek, which went completely dry.
- All sites exceeded the Salmonid spawning temperature standard during June and July. All of these streams had discharges of 1 cfs or less during this time. Significant correlations ($p<0.05$) between TSS and TP suggests that phosphorous released into the water column was mobilized by sediment disturbance.
- Observations and the data suggest that grazing is a contributor to sediment mobilization. The data suggest that grazing is the main contributor to sediment mobilization.

- Bacteria problems were greatest around May and June, and the data suggest that grazing is a contributor because cattle were observed in the streams during this time (conclusions from Myler, August 2002).

IASCD monitoring will be performed in the 2005, to monitor success in load reductions in Cottonwood creek and tributaries.

BMP Effectiveness Results

BMP effectiveness reviews –BMP effectiveness will generally be monitored by the IASCD monitoring plan. More specific reviews took place utilizing soil quality, RUSLE, spot checks, and photo plots.

Soil Quality - A total of 34 sites have been sampled within the boundaries of the Cottonwood Watershed on cropland that has been enrolled in the section 319/WQPA conservation programs. Figure 25 shows the location of the sites.

Several different tests were performed and a variety of data collected at each site. The results are shown in Table 4.

Table 4. Baseline soil quality data results for South Fork Cottonwood Creek.

	Minimum	Average	Maximum
Standardized respiration (lbs CO2-C/ac/day)	25	73	210
Infiltration rate (minutes/inch)	1.2	64	600
Surface bulk density (g/cm3)	0.6	0.9	1.2
Subsoil bulk density (g/cm3)	0.8	1.0	1.2
Water Filled Pore Space (WFPS) (%)	11	37	58
EC (dS/m)	0	0.4	0.9
PH	4.9	5.5	6.4
NO3-N (lbs NO3-N/ac)	4.4	22.2	215.8
Water stable aggregates (%)	1.8	37.3	71.7
Average soil slaking rating	1.1	2.4	4.5
Total earthworms (# /ft3)	0	1.5	8
Soil structure index	0	34	75
Organic matter (%)	3.4	5.3	8.0

A summary of the findings includes the following:

- The range in respiration data is highly variable, from medium to unusually high microbial activity, and the data represent this variability. To decrease the effects of field variability due to stage of growth and disturbance, samples in the future should be taken at similar crop stages or in the inter-row.
- Infiltration rates varied widely, from slow (300 to 1,000 min/in) to very rapid (less than 3 min/in) with the average being moderate (30 to 100 min/in). The data showed a trend of minimum-till fields having a slower infiltration rate than fields having four or more years of continuous no-till/direct seed.
- Bulk densities were lower than expected (less than 1.2 g/cm3). More quality control on the bulk density test procedure would potentially uncover any errors being made in sampling or handling of samples.
- Water Filled Pore Space (WFPS) data varied from too dry to optimum. About 30 percent of the samples taken had WFPS below 30 percent, therefore being too dry to standardize the microbial respiration for moisture. If there were an error in the bulk density values or water content values, this would affect the WFPS calculation and may change the values.
- Electrical conductivity (EC) is a measure of the salt content in the soil. All values within the Cottonwood watershed were non-saline, indicating no salt problems exist.
- The range in pH values was 4.9 to 6.4, indicating some acidic conditions. Nitrate availability is limited below a pH of 5.5, which directly affects crop growth. Historic pH ranges (1961 – 1976) for the soils

sampled were from 5.6 to 7.3 (USDA-SCS; 1982). These historic ranges could be contributed to parent material. Decreases in pH values since that time are likely to be caused by fertilization impacts on the cropland. An active nutrient management program has been implemented with the no-till/direct seed program and should minimize these effects in time.

- Nitrate levels at the time of sampling for this project ranged from low to very high. Levels of nitrates seemed to be a direct function of timing. For future samplings and data analysis the fertilizer dates need to be collected to better analyze the data.
- Aggregate stability ranged from highly unstable to stable (65 to 81 percent) for the soil types sampled. Organic matter contents and textures were constant for the sites sampled, so higher values were due to increased root growth and microbial glomalin. Fields that had been in pasture previously where root growth was abundant had the highest aggregate stability and minimum till fields had the lowest aggregate stability. This shows an improving trend as root growth and microbes increase within the soil.
- Soil slaking ratings varied from the unstable range to low stability and strength. For the soils sampled, the variability was in glomalin contents. The higher ratings were, in general, from fields that had been in no-till/direct seed systems for a longer period, indicating no-till/direct seed systems over time are effectively reducing sediment losses from fields.
- Earthworm counts ranged from 0 to 8 worms in a cubic foot. Sampling that is collected too early under cold conditions or too late under hot, dry conditions yielded no worms even in fields with high residue levels. Under optimum sampling conditions, total worms increased with increased residue or food sources, which were more prevalent in a no-till/direct seed system.
- Structure ratings varied from 0 to 75, with the higher rating in fields that had been in pasture prior to being direct seeded. In general, as time in a no-till/direct seed systems increased, the better the soil structure. The better the soil structure the better the infiltration rate, which in turn reduces soil runoff.
- The organic matter contents measured in this study averaged 5.3 percent. The highest organic matter contents were in the fields that had been in pasture before crop production with a direct seed system. In addition to high organic matter contents, fields that have been in a no-till/direct seed system have high levels of decomposing residues on the surface of the soil that hold moisture and reduce soil temperatures allowing better microbial activity and more decomposition of the residues.

In conclusion, this data is good baseline data, indicating a positive trend in soil quality with increased years of no-till/direct seeding. Further testing at the third year and sixth year into the contracts should substantiate this trend.

Administration

The district board set watershed priorities by determining which BMPs would make the most impact towards meeting water quality goals. Cost lists were developed through numerous meetings with the Idaho Soil and Water Conservation District (ISWCD) board, the Cottonwood Creek WAG and the Cottonwood Creek advisory committee. Modifications to the cost lists were submitted to the ISWCD board and approved by the ISWCD board at a regularly scheduled board meeting. NRCS and SCC personnel developed contracts and conservation plans with the District approving the contracts, plans and modifications. The Conservation district compiled payment applications and the ISWCD board approved payments as well as preparing financial records for annual audits.

Public Outreach

The conservation district has implemented an information and education program targeting potential project participants, landowners, and operators within the watershed and Idaho County:

- The first educational program netted twenty-five agreements for contracts.
- Watershed meetings, tours, and newsletters were used to highlight public awareness of BMPs and their effectiveness, the TMDL process and the progress of the implementation plan. Local media outlets were utilized to disseminate watershed activities and broader issues of water quality to the general public. A tour was held June 2002, and 50 people attended. The tour spotlighted the direct seeding and no-till practices being implemented within the Cottonwood watershed, with featured producers discussing their successes and challenges.
- In February 2003 and February 2004, the District gave an update on the project at the annual cereal growers meetings in Greencreek, Idaho. The District also had an informational booth promoting the Cottonwood TMDL Implementation at the Idaho County Fair (August 2001, 2002, 2003, 2004).
- Indirect public outreach was accomplished at the South Fork Clearwater (SFC) WAG meetings in 2003/2004. The SFC WAG was informed of the voluntary participation in the Cottonwood Creek TMDL Implementation.

Total Project Costs

Total project costs are shown in Table 5.

Table 5. Total project costs for South Fork Cottonwood Creek.

	WQPA ($)	319 ($)	Landowner ($)	Other ($)	Total ($)
BMP Cost-Share	105,351	235,705	294,019		635075
Administration	5,596	25,718			31,314
Outreach	606	5,759			6,365
Tech. Assistance				70,000	70,000
Monitoring				15,000	15,000
Other					
Subtotal	111,553	267,182	294,019	85,000	757,754

Project Conclusions and Recommendations

The project has been successful:

- We have educated many landowners, operators and public citizens about water quality issues
- We have had substantial volunteers for water quality projects with more envisioned in the future
- Planned BMPs are working toward the objectives for this project
- Thus far, we have reached 23% of our project critical acres with section 319 and WQPA projects and 34% with all projects for the South Fork of Cottonwood (23% of the total Cottonwood watershed critical acres objective).

Figure 24. July 9th, 2005, DEQ Field review of the Cottonwood section 319 – Implementation of BMPs. Left to right: Cliff Tacke, Cottonwood WAG Chairman; Ed Stuivenga, ISWCD Supervisor; Leon Slichter, ISWCD Supervisor; Jerry West, DEQ; Pete Lane, ISWCD Supervisor; Scott Wasem, ISWCD Supervisor; John Cardwell, DEQ.

This page intentionally left blank for correct double-sided printing.

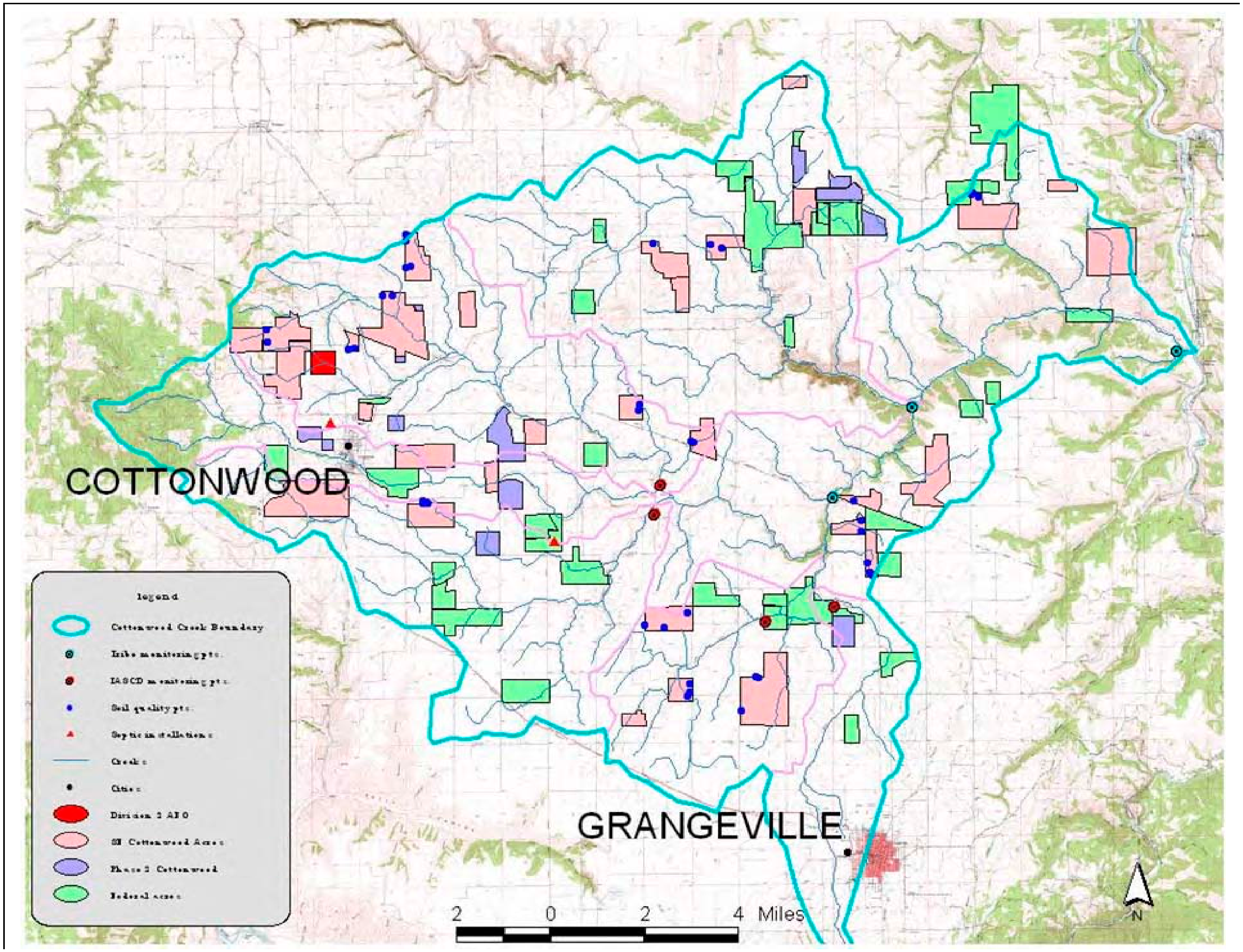

Figure 25. Cottonwood BMP Implementations (11/04).

Implemented Best Management Practices

Figure 26. Direct Seed reduces runoff and sediment losses from fields due to the amount of residue left on the surface. In the Cottonwood area, there is approximately 10 tons/acre/year of sediment reductions due to direct seed and no-till systems.

Figure 27. Residue remaining in this minimum tillage field is significantly lower than residue rates in direct seed systems. The additional residue in direct seed systems slows runoff waters allowing infiltration into the soil and lowers sediment losses from the fields.

Figure 28. Sediment basins collect sediments and reduce the amount of sediment and nutrients entering streams and other water bodies. This sediment basin is seen completed in the fall (right) and full of water and sediments in the spring (left).

Figure 29. The runoff depicted is typical of summer fallow systems in the Cottonwood area before cooperators converted to direct seed systems. In areas where landowners are not converting to direct seed, some landowners are installing sediment basins to collect sediments.

Figure 30. Filter strips, serve to reduce sediment, bacteria, and nutrients entering water bodies. This is accomplished by slowing water velocity, allowing contaminates to settle out of run-off waters.

Figure 31. Fencing (left) reduces impacts to stream banks, and direct access to live water allowing streams to recover and pollutant loads to be reduced. The green re-growth along the creek in this photo is one season of re-growth.

Figure 32. Culvert crossings provide livestock access to additional pasture areas with minimal impacts to stream banks and creek waters.

Figure 33. Sediment Basin two years after installation. Fifteen tons of sediment has been removed each year from this basin.

Figure 34. Corral berms help to contain corral water and manure, allowing pollutants to settle and keeping them from entering the creek.

Upper Thomas Fork Creek Stream Bank Stabilization Projects

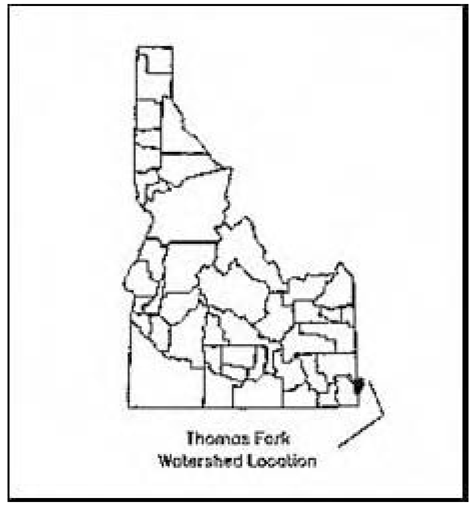

Figure 35 Location of Thomas Fork Creek.

Introduction

The Bear Lake Regional Commission (BLRC) initiated this project to address an identified sediment and dissolved nutrient loading problem in the Thomas Fork Creek. Specifically, a targeted reach of the Thomas Fork Creek in Bear Lake County, Idaho was selected for implementation of stream bank stabilization practices that were proven effective on prior projects on the Thomas Fork.

Project Goal and Objectives

The overall goal of the project was as follows:

"Improve the quality of water in the Thomas Fork Creek and stabilize the banks within the targeted reach, so the stream can sustain its beneficial uses as well as improve water quality conditions within the Bear River and Bear Lake."

The following objectives are specifically intended to meet the above goal:

Objective 1 Apply riparian and in-stream reclamation treatments along the Thomas Fork Creek for approximately 1,750-2,000 feet along degraded riparian zones.

Objective 2 Develop and implement a project administration, evaluation and environmental stewardship program that determines the effectiveness of the proposed activities and promotes their long-term care.

Key Issues

To meet the above stated goal and objectives and to accommodate the needs of the landowner, this project addresses the following issues:

- Restricting livestock access to Thomas Fork Creek in this section with a fence and controlled water access.

- Commencing riparian restoration due to a lack of riparian vegetation resulting in unstable bank conditions. Unstable bank conditions ultimately increase the total suspended solids within this reach of Thomas Fork Creek.

Description

The bank conditions found were vertical banks 7 to 12 feet high. The permitting and implementation of the BMPs were under the direction of the BLRC with assistance from the landowner. Monitoring by Ecosystem Research Institute of Logan, Utah included water quality chemistry and surveys of stream cross-sections.

Accomplishments

Outputs from the project include:

- Installation of BMPs on approximately 2,400 feet of stream bank and erection of exclusionary fencing at strategic locations along the riparian area adjacent to pastureland.
- Monitoring using three methods
- Water chemistry at one site
- Photo monitoring at each of the treatment sites
- Stream cross-section surveys at four locations in the project area
- Information and education display at the Bear Lake County Fair, fall 2005, presenting information about the project
- Landowner maintenance agreement on completed project work

Background

The Thomas Fork Watershed (Figure 36) consists of 150,100 acres located in Bear Lake County, Idaho and Lincoln County, Wyoming. The elevation of the valley floor of the watershed is about 6,600 feet above sea level. Thomas Fork Creek is a tributary to the Bear River immediately upstream from the diversion of the Bear River into Bear Lake. Bear Lake has been designated by the State of Idaho as a Special Resource Water. Thomas Fork is listed as a 303(d) stream not supporting the beneficial uses of cold water biota, salmonid spawning and primary and secondary contact recreation.

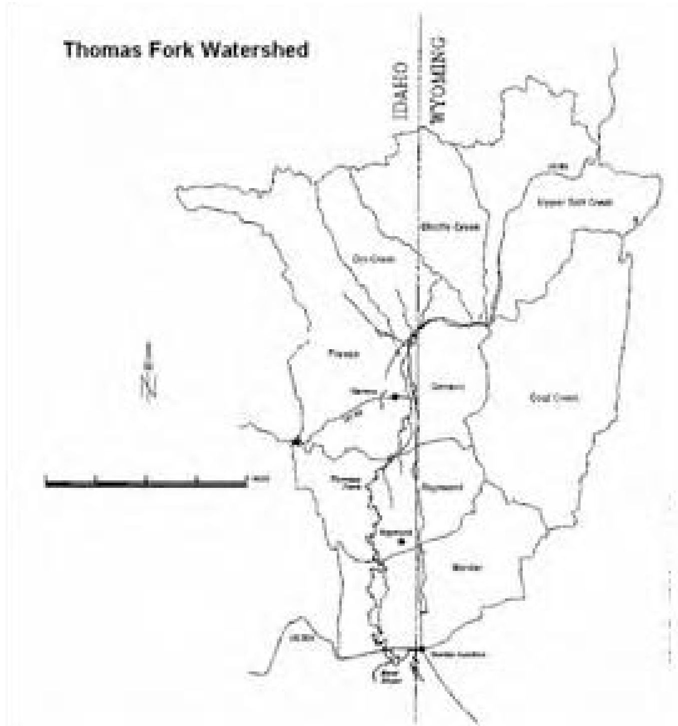

Figure 36. Thomas Fork Watershed.

Thomas Fork Creek represents a valuable resource of concern. However, in addition to the values of the Thomas Fork, the eutrophication of Bear Lake and the degradation of the Bear River is due, in part, to excessive stream bank erosion from Thomas Fork.

Methods

This project employed BMPs used on prior treatment sites in the same general area. These BMPs have been in place for over seven years. During the grant application process, for this project, thirteen sections of stream bank were selected for the installation of BMPs.

Construction of BMPs on the thirteen sections were completed during 2003 and 2004. Five different types of BMP treatments were employed. They included stream bank shaping, bank barbs, rock rip-wrap, toe armoring, reseeding, willow plantings.

Description of Treatments

Bank shaping involves the use of heavy equipment to excavate excess soil from the stream bank and reduce the angle of repose. A trackhoe has proved to be superior to a backhoe based on reach and stability.

Toe armor consists of large rock placed at the toe of the slope to prevent constant wave action from removing soil on recently excavated slopes.

Rip-rap is applied using landowner equipment. Rock is placed from the toe of the slope to near the crest of the bank. Local geologic material is used as rip-rap to keep soil in place until vegetation can root. Geologic material is quarried from nearby a nearby site and is composed of dense, angular material.

Grass seed was used to keep soil in place and uptake nutrients. Each site is prepped using steel grate dragged along surface. Seed was spread by hand to prepped, treated sites and also to areas rip wrapped.

Seeds were covered to prevent predation by animals. The seed mix is composed of drought-tolerant native species to encourage natural function and consists of Sheep Fescue, Crested Wheatgrass and Stream bank Wheatgrass. This mix was selected based on site conditions and agronomist recommendation.

Stream barbs applied to this project were constructed of native geologic material mined from local quarries using NRCS design from previous project along the same stretch. Core material is 1'-3' in diameter while cover material is 2"-10" in diameter and highly angular. Each barb was anchored into the bank and extended into the flow along the streambed, at a 45° angle, and directed upstream.

Willow stock was produced on site from existing healthy communities and placed to maximize rooting. Cuttings were placed at .5' intervals along treated areas or other areas as needed. Each cutting was pressed into the soil near the waters edge to make use of the water table. Density of cuttings was increased at rock barb locations.

Monitoring

Monitoring of this project included photographs, stream transects, and water chemistry:

- Photo monitoring includes photos before, during and after construction, plus bi-annually after construction. Photo monitoring will continue for 2-3 years on semi-annual rotations to document the longer term success at this site.
- Cross-sections of the creek were surveyed to document channel movement and stability along a stretch of treated stream bank. Three transects were established along the stretch to be treated. One additional transect is installed below the treated areas as a control point. These transects were surveyed before and after BMP implementation to define the effects of BMPs on channel stability.
- Water chemistry samples are used to quantify the success of BMP implementation on water quality. Water quality parameters are sampled on a quarterly rotation and submitted to an EPA certified laboratory for analysis. Constituents sampled consist of: nitrate, nitrite, ammonia, orthophosphorus, total phosphorus, and total suspended solids. Grab samples were collected downstream from treated areas and transported to the lab for further analysis.

Maintenance agreement

An agreement for maintenance of the stream bank BMPs was signed by the landowner and is on file with the Bear Lake Regional Commission.

Involvement of the public and other agencies

In addition to the Bear Lake Regional Commission, several other public and private organizations were involved with this project at different levels.

The location of this project with respect to US Highway 89 required cooperation with the Idaho Department of Transportation. Sections 6 and 7 of this project are within close proximity of US Highway 89. The close proximity of the project to the highway right-of-way required excavation work to take place within the right of way. Agreements were made with the Idaho Department of Transportation to work in the right-of-way. The Idaho Department of Transportation also donated time and equipment to transport excavated material to upland sites.

Without implementing BMPs on sections 6 and 7, Thomas Fork would have shortly toppled an existing power line on this landowner's property. Prior to construction, a power pole owned by Utah Power and Light was within one foot of toppling into the Thomas Fork. Efforts were made to coordinate with PacifiCorp power utility for removal of the power pole with excavation work as part of bank shaping.

Other organizations not directly linked to this project were instrumental in the implementation of BMPs. Bear Lake Watch, an organization devoted to involvement in many aspects of Bear Lake and Trout Unlimited were both represented by volunteers aiding in implementing BMPs. Membership from both groups contributed to the success of this project by planting willows on different segments of the project.

A fair booth was erected during the annual Bear Lake County Fair. The booth detailed the work engaged by the regional commission along Thomas Fork for the past seven years.

Results

The results section includes a narrative of the condition of BMPs after implementation and the monitoring information. Each treated area is considered as a segment and a description of type and amount of BMP implemented at each treated area is reported. Monitoring results include: water chemistry samples, photo points and surveyed cross sections. Segment reaches have been plotted on an aerial photo of the area (Figure 37).

Overall, treated areas are responding well to applied BMPs. Several unique factors appear to have strongly influenced this project. Willows were planted during July along segment 7 with incredible success. Figure 38 illustrates the condition of the willows one month after planting. This is unusual because willows planted in July often show signs of stress not long after planting and soon perish. It could be asserted that this success is due in part to above average precipitation falling at this location. Afternoon rainfall followed by cooler temperatures appears to have provided needed moisture for growth. Based on comparative observations with other projects completed by the Bear Lake Regional Commission, the additional moisture during the summer appears to have greatly improved survival rates for the willows (at least temporarily) and grasses.

Financial resources to acquire exclusionary fencing and water gaps will also help to achieve the goals and objectives of this section 319 grant. Over 8,000 linear feet of fencing was purchased to prevent animals from grazing new riparian grasses. This fencing was to be installed by the landowner and labor costs applied as match to the project. Early snow and late rains have slowed this effort, but verbal commitment from the landowner provides assurance that the fencing will be completed in the near future. Presently, installation of exclusionary fencing is 80% complete.

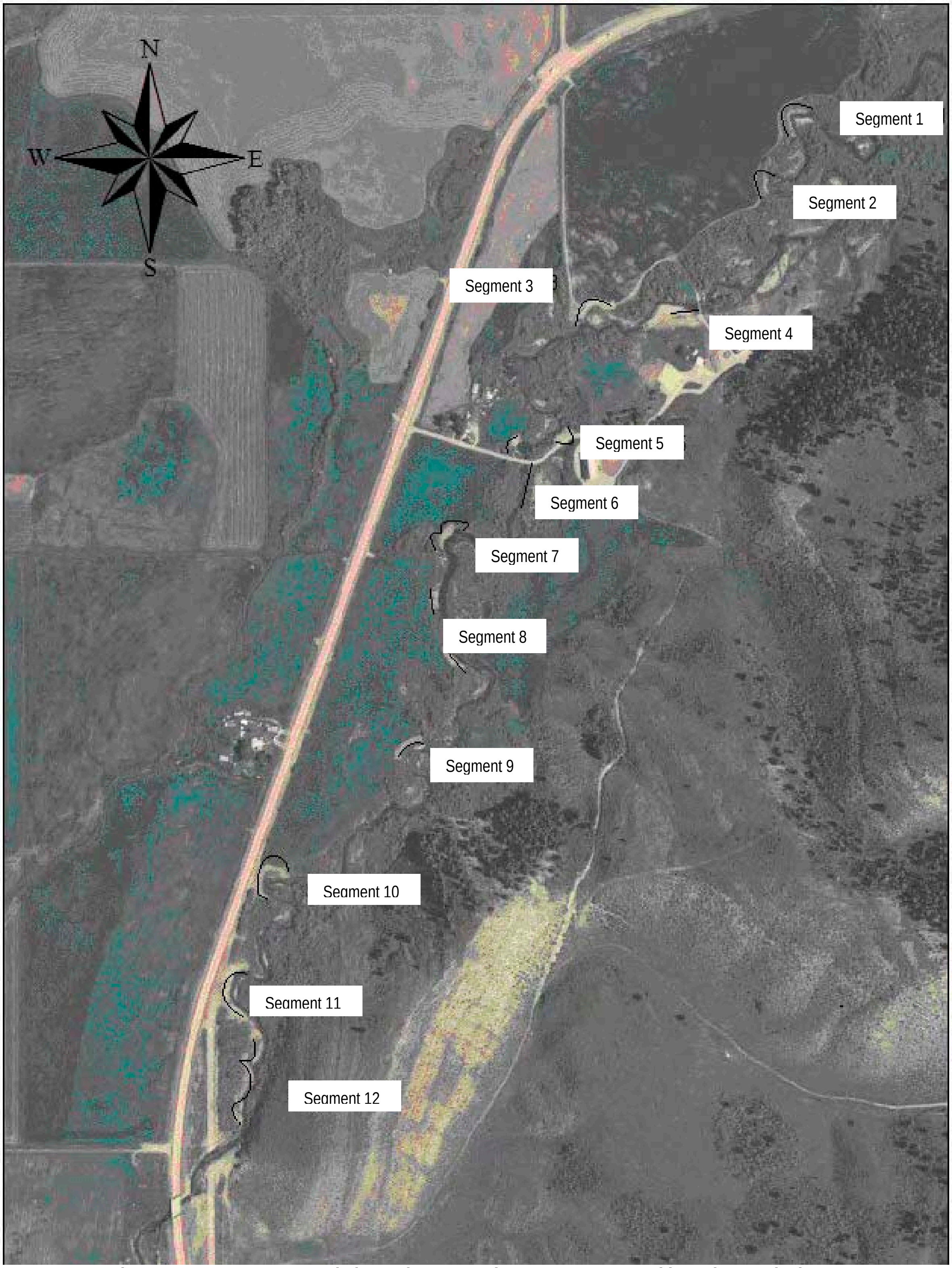

Figure 37. Segments treated along Thomas Fork on property owned by John Carricaburu.

Further description of each type of BMP implemented at each location and their condition one year after implementation is provided below.

Segment 1

Project construction was initiated and completed during the fall of 2004 on Segment 1. 160 linear feet of highly degraded stream bank were treated with rip-wrap, two bank barbs, toe armor, willow plantings, and reseeding techniques. Most of these treatments are in excellent condition. Willow cuttings that were planted during 2004 are virtually non-existent.

Segment 2

Construction was initiated and completed during the fall of 2003, along 100 linear feet of degraded riparian area. Treatments applied at this location include: rip-wrap, toe armor, three bank barbs, willow cuttings, reseeding, and sedge plugs. Most of the techniques implemented are in excellent condition. Willow plantings and sedge grass plugs are in poor condition or non-existent. Other improvements employed at this segment were the removal of existing (unapproved) stabilization practices. Three cars were removed from their placement along Thomas Fork Creek as erosion control many years ago. These treatments were removed from the stream and transported to a more appropriate location. Photos were taken before and after rehabilitation (Figure 38, Figure 39).

Segment 3

Once the primary channel for Thomas Fork Creek, this channel has now been largely abandoned except during high-flow events. However, during high flow events, unstable bank conditions contribute sediment and off site nutrients to the Thomas Fork. Implementation of BMPs was initiated and completed during Fall 2003. BMPs implemented along this 126 linear foot segment include: bank shaping, willow planting, and revegetation. All of the treatments are in excellent condition.

Segment 4

Season considerations of this 150 foot long segment encouraged the postponement of this segment until later. Start and finish at this location occurred during the spring of 2004. Treatments include toe armor, rip-wrap, willow plantings, grass reseeding, and two barbs. Most of the treatments applied at this location are in excellent condition. The barbs seem to have washed away and the willow growth at this location is poor.,

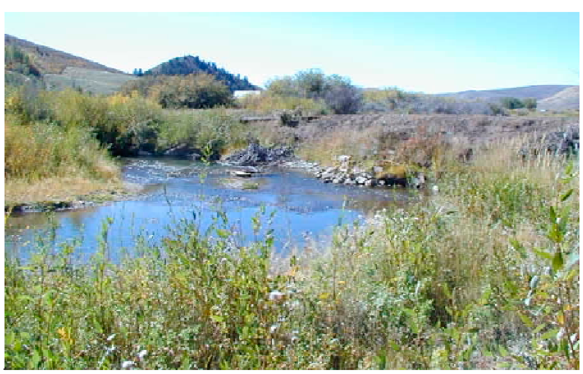

Figure 38. Segment 2 prior to treatment with BMPs.

Figure 39. Segment 2 after treatment with BMPs.

Segment 5

This segment considers two small, separate cut banks that are within close proximity but which will be distinguished as upper and lower. Combining the two under the same segment heading simplifies describing them as they are within close proximity, yet difficult to separate on the map. The upper section is 35 linear feet and included the following treatments: bank shaping, toe armor, one bank barb, rip-wrap, willow plantings, bundles, and reseeding. Most of the treatments at this location are in excellent condition. Willow plantings and bundles appear to be non-existent except for pre-existing material.

Treatments applied along 65 linear feet at the lower site are similar to those at the upper site with the addition of removing previous attempts at protecting the stream bank. Approximately four hours were spent removing abandoned concrete slabs that had been placed at this location to prevent further erosion of cropland. These relics were removed to an upland location away from the stream.

Segment 6

125 linear feet along segment 6 was not considered as part of the original application to perform this work at this location. Between the time the application was submitted and approved, appreciable loss had taken place to warrant treatment. BMPs applied at this location include: bank shaping, and reseeding. Reseeding treatments appear to be successful.

Segment 7

Treatments applied along 100 linear feet at segment seven provided results contrary to convention. Treatments included bank shaping, willow planting, and reseeding. Willows were planted during July, which is contrary to popular convention; leading science suggests that willow regrowth is maximized when planted in early spring or late fall when plants are dormant. One month after planting, nearly 100% of those plantings were alive and healthy (Figure 40). Grass seed spread approximately the same time was also growing in abundance. One year later, nearly all of the willows are gone. Ninety-eight (98) percent of those still at the site have produced new growth and appear healthy. However, many of these same plants were either consumed or hauled away by beavers (Figure 41).

Segment 8

Treatments applied at segment 8 are identical to those implemented at segment 7 because of similar conditions. Treatments along 250 linear feet include bank shaping, willow planting, and reseeding. Results are also similar to segment 7. Many of the willows have been removed but 90% of those still standing are alive and well. Grass seed is propagating rapidly and can be observed stabilizing existing conditions.

Figure 40. Success of willows planted in July (photo taken one month after planting).

Figure 41. Segment 7 willow plantings after one year.

Segment 9

Treatments applied along this segment include toe armor, rip-wrap, reseeding, willow planting. All treatments applied along this 173 foot segment are in excellent condition save the willows.

Segment 10

Treatments along 240 linear feet of unstable stream banks at this segment include bank shaping, toe armor, rip-wrap, willow planting, and reseeding. Similar to other segments, all treatments applied were in excellent condition. No willows were planted at this site due to miscommunication with volunteers and lessons learned from upstream segments.

Additional help was received from the Idaho Department of Transportation during bank shaping at this location. This segment was within close proximity to right of way owned by the highway that was being threatened by Thomas Fork. The Department of Transportation donated time and equipment necessary to haul away overburden created by bank shaping and safety personnel while working in the right of way. Over 21 dump truck loads of soil were removed from this site and transported to an upstream location by the Idaho Department of Transportation.

Segment 11

Treatments along this segment of highly eroded stream bank (Figure 42) include: bank shaping, rip-wrap, grass seed, and two bank barbs. These treatments were applied along 400 linear feet of stream bank to stabilize the channel meandering toward US highway 89. All of these treatments are in excellent condition (Figure 43). Willows were not planted at this location. Unsuccessful results at upstream locations were cause for not using this treatment at this location.

Idaho Department of Transportation was instrumental in assisting the Bear Lake Regional Commission during bank shaping at this location. Similar to Segment 10, this segment was close to the highway and required excavation activities to take place in the right of way. Idaho Department of Transportation donated time and equipment for the purpose of removing soil accumulated during bank shaping activities. Twenty-two dump-truck loads of soil were transported from this site to an upstream location courtesy of the Idaho Department of Transportation.

Figure 42. Segment 11 before treatment with BMPs.

Figure 43. One year after implementation of BMPs, Segment 11.

Not originally part of the proposal, this area showed evidence of unstable bank activity. Treatments applied at this location include: bank shaping and reseeding. Both treatments are in excellent condition and are aiding in reestablishing a healthy riparian zone.

Water Chemistry

One station on Thomas Fork Creek was sampled during 2004 and 2005 as part of the Thomas Fork Bank Stabilization Project. This location has been used as an upper sampling site for several years and was suitable as a sampling location for this project because of its location below the project area. Grab samples were analyzed for nutrients (nitrate+nitrite, ammonia, total phosphorus and orthophosphorus) as well as total suspended solids. Increases observed in water chemistry could be attributed to stream flows greater than observed during the last five years. Nutrients and total suspended solids were analyzed at an EPA certified water laboratory.

An overall decrease in total inorganic nitrogen (TIN) load (expressed in lb/yr) in Thomas Fork Creek above upper Geneva Bridge has occurred since the completion of construction and bank stabilization projects within the Thomas Fork drainage. Nitrogen has been a target water quality parameter because of the dairy activities in the watershed and the high concentration of TIN observed in the Thomas Fork in the initial water quality investigations in the watershed.

Total suspended solid (TSS) was chosen as a monitoring parameter because of the direct correlation to unstable stream banks and the potential for future stabilization projects along Thomas Fork Creek. Reductions in concentration have occurred since 1999. It is not surprising that these concentrations would be decreasing given the number of linear feet of stream bank treated with BMPs along Thomas Fork.

To determine the magnitude of water quality improvements seen since the bank stabilization project began in 1997, nutrient loading at the Thomas Fork at Upper bridge (expressed in lb/day) for dissolved orthophosphorus, total phosphorus and total inorganic nitrogen (NH_3+NO_3+NO_2), and total suspended solids (expressed in tons/year) was compared over the period on projects implemented.

Nutrient loading for all four parameters decreased dramatically over the time period. All of the parameters display similar behavior following high flow events. 1998 and 2005 were the only high flow events over the last seven years.

Total phosphorus and orthophosphorus achieved similar reductions around 54%. Total phosphorus was reduced from 14,744 lbs/year to 8,135 lbs/year and orthophosphorus was reduced from 7,033 lbs/year to 3,050 lbs/year.

Total inorganic nitrogen loading was reduced by 73% from 30,707 lbs/year to 8,135 lbs/year. Reductions in total suspended solids were by the far the greatest with 93% from 21,465 tons/year to 1,417 tons/year.

Conclusions

Areas treated with BMPs along these segments appear to have accomplished their design by reducing sediment and nutrient inputs to Thomas Fork Creek. Overall, a majority of the areas treated within the scope of this project are functioning well.

Water chemistry sampling suggests that treatments applied have reduced the sediment and nutrients entering the Thomas Fork Creek. Cross-sectional surveys of Thomas Fork Creek indicate treatments have stabilized the stream bank without causing adverse channel migration downstream. Documentation through photo points and other locations along the project help support the results of the water chemistry monitoring and surveyed cross-sections.

Kinsey Corral Relocation and Riparian Fencing Project

McMullen Creek is listed on the State of Idaho's 1998 303(d) list of water quality impaired waters. The pollutants of concern are bacteria (*E. coli*), sediment, and phosphorous. The existing beneficial uses under the Upper Snake River TMDL for McMullen Creek are agricultural water supply, cold water aquatic life, secondary contact recreation and industrial water supply.

Funding Sources

Twin Falls Soil & Water Conservation District sought out funding to assist the Kinsey family in implementing best management practices on McMullen Creek. The District and the Kinsey family combined different sources of funding to get these BMPs on the ground. The funding sources include section 319 grant money, Soil Conservation Commission Water Quality grant money, a Soil Conservation Commission Water Quality loan to the Kinsey family, NRCS Environmental Quality Incentives Program (EQUIP) funding, and a great deal of matched labor by the Kinsey family.

Accomplishments

This project applied riparian BMPs to address water quality concerns relating to the Kinsey family animal feeding operation on McMullen Creek. The Kinseys wintered 500 head of cattle for approximately 180 days a year. The confined feeding operation was built over the top of and drained directly into McMullen Creek. These corrals were removed and new corrals were built approximately 1 mile south of McMullen Creek.

All runoff from the new corrals is contained in a waste storage pond designed to appropriately hold 180 days worth of waste storage runoff. All necessary berming has been constructed to eliminate any potential runoff from entering any waterways. Once the old corrals were removed, the site was completely cleaned up of all the old storage sheds and debris. This site has been seeded to pasture grass.

The entire project site on each side of McMullen Creek has been fenced off from cattle grazing. The fencing begins at the High Line Canal and continues along the Creek to the north end of the property. The fencing-off of McMullen Creek means total exclusion from all cattle grazing.

Three off-stream watering troughs will be installed in the spring of 2006. The riparian areas on McMullen Creek were so saturated this fall the trench could not be dug to install the pipe to feed the watering troughs.

The Natural Resource Conservation Service and the Twin Falls Soil & Water Conservation District will work closely with the Kinsey family to ensure that the off stream watering is completed in the spring of 2006. The new corrals included the placement of gravel, concrete, steel panels, and the installation of frost-free water troughs (including the electricity to operate them.

All work completed to date has been in accordance with the appropriate Idaho NRCS Standards and Specifications.

Water Quality Monitoring

Water quality monitoring was done before the implementation of this project, from 2001-2002,. and this past irrigation season (2005). Since all of the components of this project have not been completed, monitoring will continue through the fall of 2006.

Table 6 through Table 9 provide a summary of all collected data.

Table 6. Kinsey Corral 2005 TSS (mg/L) means and loads (lbs/day).

Site	Av. Q	Mean. TSS	TSS Load
	cfs	Tons/yr.	Tons/yr.
MC2	6.57	8.45	54.61
MC3	0.41	6.27	2.53

Table 7. Kinsey Corral 2001 TSS (mg/L) means and loads (lbs/day).

Site	Av. Q	Mean TSS	TSS Load
	Cfs	Tons/Yr.	Tons/yr.
MC2	3.04	5.80	93.8
MC3	0.41	0.47	1.05

TSS at MC2 decreased by 42% from 2001 to 2005.

TSS at MC3 increased by 141% from 2001 to 2005. However, MC3 loads are quite low; we feel that with the fencing off of McMullen Creek this fall will decrease this sediment load by an estimated 65%.

Table 8. Kinsey Corral *E. coli* Data, MC2.

MC2			
Site	Av. Q	Av. *E. coli*	*E. coli* Load
	cfs	cfu/100 mL	lbs/day
2005	6.57	78	12.52
2001	3.04	676	48.01

74% reduction in E. coli at MC2.

Table 9. Kinsey Corral *E. coli* Data, MC3.

MC3			
Site	Av. Q	Av. *E. coli*	*E. coli* Load
	cfs	mg/L	lbs/day
2005	0.41	38.3	0.38
2001	0.41	156.5	1.57

76% reduction in E. coli at MC3.

Figure 44. Corrals built directly on McMullen Creek before cleanup.

Figure 45. Kinsey Corral: old corral site after cleanup.

Figure 46. Kinsey Corral: riparian area after cleanup.

Figure 47. Kinsey Corral: new corrals rebuilt one mile away from McMullen Creek.

Figure 48. Kinsey Corral: another view of the new corrals.

This page intentionally left blank for correct double-sided printing.

Perrine Coulee Irrigation Return Flow Settling Ponds and Wetlands Projects

The Main Perrine Coulee originates from diverted water from the Low Line Canal approximately 3.5 miles southeast of Kimberly. The Coulee system begins in the agricultural and grazing zone of the Rock Creek drainage and undulates through miles of agricultural and grazing lands, crossing the McMillan area prior to entering the City of Twin Falls.

The coulee runs through the College of Southern Idaho campus and enters a wetland area built just south of North College Street. Then it runs back into agricultural and grazing lands on the northwest side until it comes to the Snake River Canyon Rim where it forms the Perrine Coulee Falls, entering the Snake River canyon, where it splatters amongst lava rocks and runs through wetlands prior to discharging into the Snake River at the Centennial Falls Park.

Throughout the whole length of the Main Perrine Coulee, a myriad of groundwater seeps impact the stream feeding it with additional water. The Main Perrine Coulee watershed drains a total area of approximately 21,000 acres of gravity flow irrigated agricultural land.

Problem

The Perrine Coulee watershed has been delivering excess sediment, nutrients, and bacteria to the Middle Snake River and impairing the designated beneficial water uses. Designated beneficial uses for the Middle Snake River from Rock Creek to Shoshone Falls include cold water aquatic life, salmonid spawning, primary contact recreation, secondary contact recreation and agricultural water supply.

The *Upper Snake Rock Watershed Management Plan* has been written and approved by the Twin Falls Regional Office (TFRO) and has defined the Perrine Coulee as one of the coulees where reductions in TSS, TP, and *E. Coli* will have a significant impact on the Middle Snake River.

The Perrine Coulee project is located at 42°31.86 N., 114°24.83 W. The HUC is 17040212-013 or the Shoshone Falls watershed. In the *Upper Snake Rock Watershed Management Plan*, this HUC is known as the Perrine Coulee Complex.

Plan

To help achieve the reductions in pollutants, the Twin Falls Canal Company, along with the Snake River Soil & Water Conservation District and TFRO, looked at ways to decrease the pollutants of concern on the Main Perrine Coulee.

Even with the conversion from furrow irrigation to sprinkler irrigation, it has not been enough to reduce the amount of runoff leaving agricultural fields. The *Compendium of Best Management Practices for Controlling Polluted Runoff*, (Meitl, Maguire 2003) lists best management practices for controlling runoff, with sediment retention wetlands among the suggested BMPs. It was decided that this would be the most beneficial way to achieve water quality goals in the Main Perrine Coulee and, therefore, the Snake River.

Actions

There are now two sediment basin/wetland complexes on the Main Perrine Coulee, which were funded through the NPS Program. The grant was awarded and construction began in October of 2003. The Snake River Soil & Water Conservation District purchased the property on which the project was built and has signed a perpetual conservation easement.

The Perrine Coulee Wetland Project covers approximately 14 acres. Perrine Coulee water is diverted into two main ponds:

- The first pond acts as an initial sediment pond. The pond is narrow and long and will be easy for the Twin Falls Canal Company to clean the sediment out on a regular basis.
- This water then moves into a 72,000 cubic yard sediment basin/wetland. This large pond is approximately 10 feet deep on the north and south ends, with fingers that extend from the center to the east and west that are planted with bulrush. In the center, there is an island, which extends for approximately 40 feet. The island has been planted with willows. The project includes construction of berms, banks and check structures. There are also concrete inlet structures and inlet and outlet culverts. Rock rip-rap was placed on the banks in areas where there was evidence of wind erosion.

Willows have been planted along the outsides of some of the banks for erosion control also. The roads in the project area are built and have been graveled for easy access. Bulrush has been planted in the wetland portion of the pond.

In April of 2005, the Snake River Soil & Water Conservation District was awarded a second grant for treatment of the Main Perrine Coulee. . This wetland is located five miles below the Main Perrine Coulee Wetland. The Snake River Soil & Water Conservation District purchased the six-acre piece of property and signed a perpetual conservation easement.

Results

Water quality monitoring data collected during the irrigation season of 2005, shows that the Main Perrine Coulee Wetland (Figure 49) is successful in removing pollutants from surface water. Water samples were taken above and below the wetland. This reduction is expected to decrease even further with the construction of the new Lower Perrine Coulee Wetland.

Background data has been collected and water quality monitoring will continue on both of these projects to get better estimates of the pollutant reductions. The total reductions for the Main Perrine Coulee Wetland are shown in Table 10.

Table 10. Main Perrine water quality data.

	TSS	TP	E. coli	N (2005)
Site 1 (above pond)	28,359.2 lb/day	89.9 lb/day	1,011.8 cfu/day	11 April-Oct.
Site 2 (below pond)	15,713.0 lb/day	67.5 lb/day	345.8 cfu/day	8 May-Oct.
% Reduction	44.6	24.9	65.8	
Estimated Load Reduction with Lower Wetland	55.6%	25.3%	53.9%	

After the Perrine Coulee exits from the Lower Perrine Coulee Wetland, it enters the City of Twin Falls where it receives storm water and urban runoff. TFRO was able to obtain grant money and furthered the treatment on the Main Perrine Coulee with two additional projects. The College of Southern Idaho (CSI)

Wetland Improvement Project increased the size of an existing wetland located on the CSI campus. This wetland complex is now double the size it use to be and will be much more effective.

The second project is the Centennial Watershed Complex and Riparian Buffer Zone. There will be a wetland complex with a 2-acre riparian buffer zone. The project is located at Centennial Park, where the Main Perrine Coulee enters the Snake River.

Figure 49. Main Perrine Coulee Wetland (Wetland located in center of photo)

Figure 50.Construction of Main Perrine Coulee Wetland.

Figure 51. Main Perrine Coulee Wetland inlet diversion.

Figure 52. Main Perrine Coulee Wetland inlet settling pond.

Figure 53. Main Perrine Coulee Wetland first water turned in.

Figure 54. Main Perrine Coulee two months afterestablishment.

Figure 55. Main Perrine Coulee Wetland outlet structure.

Figure 56. Lower Perrine Coulee Wetland construction start up.

Figure 57. Lower Perrine Coulee Wetland construction.

Figure 58. Lower Perrine Coulee Wetland construction.

Figure 59. Lower Perrine Coulee Wetland Inlet from Coulee.

Figure 60. Lower Perrine Coulee Wetland Inlet Structure.

Figure 61. Lower Perrine Wetland Cell.

Figure 62. Wetland Cell with bulrush planting.

This page intentionally left blank for correct double-sided printing.